

Science AMA Series: I'm Ying-Hui Fu, I study the genetics of sleep at UCSF. My lab discovered a gene that makes some people more efficient sleepers, needing only 4-6 hours per night. AMA!

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Abstract

There are two things I consider more important than sleep: air and water. We spend more time sleeping than engaging in any other single activity, but we know very little about how day-to-day sleep behavior is regulated. My lab uses human genetics to gain a better understanding on this topic. We've found that sleep behavior is heavily influenced by our genetic makeup. Just like many other traits — height, weight, body shape — sleep behavior is at least partly inherited. In 2009, we discovered a mutation in the DEC2 gene that allows some people to sleep only four to six hours a night and feel completely refreshed. We study such efficient sleepers in hopes to understand why sleep is so important! Ask me anything about how genes affect sleep and why we need to pay attention to sleep! Here's my lab at UCSF Here's a recent UCSF article about the impact of sleep-deprivation: Short Sleepers Are Four Times More Likely to Catch a Cold Here's a BBC article about the sleep gene, The People Who Need Very Sleep I will be back at 1 pm ET (10 am PT, 5 pm UTC) to answer your questions, AMA! EDIT: Good morning everyone. Thanks for all the great questions and lets get to the answers! EDIT: Thanks for all the great questions. I enjoyed it very much. I am signing off!

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Science AMA Series: I'm Ying-Hui Fu, I study the genetics of sleep at UCSF. My lab discovered a gene that makes some people more efficient sleepers, needing only 4-6 hours per night. AMA!

YING-HUI_FU [R/SCIENCE](#)

ABSTRACT

There are two things I consider more important than sleep: air and water. We spend more time sleeping than engaging in any other single activity, but we know very little about how day-to-day sleep behavior is regulated.

My lab uses human genetics to gain a better understanding on this topic. We've found that sleep behavior is heavily influenced by our genetic makeup. Just like many other traits — height, weight, body shape — sleep behavior is at least partly inherited.

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Ask me anything about how genes affect sleep and why we need to pay attention to sleep!

Here's [my lab at UCSF](#)

Here's a recent UCSF article about the impact of sleep-deprivation: [Short Sleepers Are Four Times More Likely to Catch a Cold](#)

Here's a BBC article about the sleep gene, [The People Who Need Very Sleep](#)

I will be back at 1 pm ET (10 am PT, 5 pm UTC) to answer your questions, AMA!

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I'm interested in how the average consumer can quantify the length and quality of their sleep, and potentially identify and diagnose their sleeping habits/problems. I primarily interested in the role that Wearable technologies could play in this space. My questions are:

1. Are current popular consumer wearables (Fitbit, Jawbone, Basis Peak, etc.) able to give reasonable insight into sleep quality? Some of these devices like the [Basis Peak](#) claim to be able to quantify light, deep, and REM sleep. What are your thoughts on the supposed accuracy of wearables tracking this?
2. I believe most of these middle price point wearables are simply tracking user movement and potentially heart rate to infer restlessness and sleep of the user. Can you comment on the effectiveness of measuring this, and advise if there are other metrics that would more accurately track the quality of sleep?

Thanks so much!

[bathmlaster](#)

I think that right now, the best way is still to listen to your body and figure out what is the best schedule and duration for yourself. For example, when you are on vacation and have no social responsibilities and no other external influences, what is your body telling you to do and how do you feel? What makes

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you feel the best most of the day? Although sounds primitive, it's still the most accurate way. You can use fitbit or whatever to measure your sleep duration, but if you don't feel good, it still has no benefit to help you with your sleep.

These popular wearables are like you suspected; they only measure movement and potentially heart rate. They cannot tell you the quality of your sleep. I am not aware of any simple wearable that can do this right now. To really know the quality of sleep, we have to be able to measure EEG during sleep. Most EEG devices are difficult to use and expensive.

I only get 4-5 hours of sleep and feel pretty good every morning. Is there any risk of this kind of sleep schedule coming back to hurt me physiologically in the future? How would I find out if I have this gene and my sleep cycle isn't caused by other outside factors?

[whiteyfresh](#)

This really depends on whether your body truly only needs 4-5 hours of sleep. From what we can tell, most of the people who truly only need 4-6 hours of sleep don't seem to have any obvious health problems.

There is no genetic testing available right now. So far, the mutations that we find are pretty rare. So, the chance that you have the same mutation is not high.

You can listen to your body. For example, when you are on vacation, what is your sleep schedule and duration like?

You stated that they 'feel' refreshed, are they really refreshed, like no negative effects on their body in comparison to norm sleepers? Also, what does the gene change that they don't need as much sleep? This should be a pretty big deal right?

[JaqueLeParde](#)

From what we can tell and from what they told us, the short sleepers are pretty energetic. And, we believe that they feel refreshed since they can go on all day and be active. We have not seen any health problems associated with these people. Some of our research subjects are in their 90s.

There are many genes involved in regulating our sleep so most likely there will be mutations on many genes that can lead to this trait.

I think this is very exciting. But, I hope funding sources will be more enthusiastic than they have been.

Two questions.

- 1. Do we have information about where, geographically speaking, populations have the highest concentration of the DEC2 mutation? Do we have a sense of the age of the mutation?**
- 2. I want this gene, but don't have it. I'd pay a lot of money for it. How long until the science is there to allow me to upgrade myself? If not me, what about my kids? How long until we can upgrade our kids with this? 50 years? 500?**

[comment_moderately](#)

In our study, the family with the DEC2 mutation has Eastern European ancestry, so I would think that the highest concentration of the DEC2 people will be there. But, we have not done in depth study on this, so this is just my guess. We don't have information on the age of the mutation.

We have so far found several different mutations on different genes for this trait. DEC2 is the only one that is published. Unfortunately, our manuscripts are held to an extra high standard so it always takes

10 or more years to get our papers out there for people to see and know. The way we are going after this is by first getting a handle on what the regulatory pathways are for normal sleep regulation. Then getting an understanding of what makes these processes more efficient. If we can get there, then we may be able to find ways to modulate our sleep in a SAFE manner, to sleep more efficiently. How long this will take depends mostly on how much research funding we can get. If we can have more funding, it will go much much faster. The current speed will take at least decades.

I have always needed 12 hours of sleep per day. Is there a similar explanation for why some people need more sleep than normal?

[PugglePrincess](#)

Sleep, like many of your other traits such as height, weight, and shape, is personal. From our study, we learned that your genetic make up has a lot control over your sleep trait. So, if you need 12 hours, it simply means your body takes that time to feel rested. How and why are something we are still working on trying to understand.

For now, we are not pursuing people who need longer than average amount of sleep. If funding allows, we could potentially look into this.

For those of us that don't have this gene, is there any way for us to feel better with less hours sleep?

[jaketorez](#)

I was one of the people who hated sleep and tried everything there was to sleep less before I started this research. Now, I wish I never messed with my sleep in my younger years. From what I know, it is not worth it. It will increase your chance of having health problems later on and it definitely will affect your mental vigilance.

So, my tip is to make sure you get good night sleep. You can help by getting comfortable sleep accessories such as pillows, bedding, etc. If your environment is noisy, use ear plugs. Do what you need to do to get your good and sound sleep.

Your research has shown that the DEC2 gene is associated with much shorter sleep duration. However, have you really demonstrated yet whether this is due to a decreased physiological "need" to sleep (e.g., due to increased "efficiency"), as your AMA title suggests, or a decreased ability to express sleep need, or some combination of both?

For example, have you established whether these short sleepers are normal cognitive performers? It's not enough to test subjective perceptions of alertness, since we know that [when individuals are chronically sleep restricted they do not subjectively sense how impaired they are](#).

Additionally, are there any long-term health problems associated with these genes? We know that individuals who habitually sleep very little also have increased risk of a myriad of health disorders, including weight gain, cardiovascular disease, and diabetes. Are these effects mediated by genes such as DEC2?

[whatthefat](#)

First, I think that we need to distinguish "natural short sleepers" and "habitual short sleepers". The people we study are specifically screened for "natural short sleepers". From my experience of talking and communicating with these people, it really is the case that they don't appear to have major health problems. And, if you have spoken to them, you will KNOW that they have normal cognitive function. For example, the woman featured in BBC article (see link in intro). She is a typical example of the

people we study. Another gentleman who is in his late 80s has a lab in US and another one in China. He travels frequently between two countries to this day.

This is very different from other kinds of short sleepers including "habitual short sleepers". If your body is not naturally (genetically) wired to only require shorter amounts of sleep and you restrict your sleep on a long term basis, you will have higher chance of having some health problems later on.

What do you think about drugs like Modafinil which supposedly lessen the need for sleep?

[jia](#)

Personally, I don't take anything other than coffee and tea no matter how busy and tired I am. My reason is that we don't really know much about how sleep is regulated right now. Most of these drugs will affect something in our brain, but we don't know how they affect it and what the long term consequences will be. My brain is VERY important to me and I just don't want to mess with it without knowing what exactly the compound is doing to my brain.

Of course, coffee and tea are also compounds (caffeine). But, at least humans have been consuming them for a long time and no significant health problem has been connected to them yet. So, I am more comfortable using them. Still, everything in moderation.

- **Has the prevalence of the mutated DEC2 gene in the general population been determined? Do the statistics vary depending on sex or race?**
- **Anecdotal evidence aside, have there been studies of differences in mental or physical fitness between people with the mutation and the general population? Are the benefits of the mutation coming at a cost?**

[frontseatdog](#)

No, we have not determined the prevalence of this mutation. DEC2 mutation is rare, but we have found other mutations in other genes. I think that when we make comparisons, we should compare natural short sleepers to regular sleepers. This is a very interesting question and it will be great to get an answer. However, it is also challenging to get these people to do extensive studies because they are usually very busy people and difficult to find time to do this. What we know now is based on our interviews and interactions with the short sleepers, and we can tell that they are different. Again, if there is any price to pay for being "natural short sleepers", we have not seen it so far.

How rare is this mutation? I always wake up after around 5-6 hours and force myself to go back to sleep since I've been conditioned to believe I need 8 hours. One thing I've noticed is I seem to feel more rested if I just stay up after I initially wake, rather than going back to sleep for another hour and a half or so.

[Alex_801](#)

Yes, most of us are told to get 8 hours of sleep according to conventional wisdom. However, we are finding out that sleep, like many other traits, is different for different people.

The DEC2 mutation is rare. But, there are many natural short sleepers who don't have this mutation. The natural short sleepers are rare, but not VERY rare either. It's true that almost all of the natural short sleepers say if they force themselves to sleep more, they actually just feel worse and even awful the rest of the day. However, without conducting an in depth interview and study on you, I cannot tell you whether you fall into this group of people.

How do the genetically gifted short sleepers fall on objective measurements of health and

longevity? For example, is their life expectancy shorter?

[vtjohnhurt](#)

From what we can tell, they are pretty healthy. Some of the participants of our study are in their 70s-90s. Even in their 70s-80s, they still play tennis, dance, and stay very active during the day. A woman in her 90s still does a lot of volunteer work including in a prison. We have, so far, no reason to suspect that their health and longevity is affected in any way.

Did you observe that people with this gene will feel more tired after getting more than 6 hrs of sleep?

[DallasGreen](#)

Yes, these natural short sleepers feel, in their own words, "awful" if they sleep more. This is true not only for people with this particular (DEC2) mutation, but also for all the natural short sleepers.

The short-sleep phenotype mouse is a neat one! How do the results you see in that one fit together with indicators of sleep homeostasis like forebrain accumulation of Per2 and forebrain clearance of Dbp associated with sleep? Are the time-in-state effects for these indicators exaggerated in these mice such that they still serve as indicators, or do they decouple from them?

Do you notice any alternations in behavioral organization (wheel running, drinking rhythm, etc) other than the animals simply spending more time awake?

And more generally, where do you see yourselves taking this model with regard to understanding mechanisms that underlie sleep homeostasis?

[Neurokeen](#)

We have not performed such an in depth study on these mice yet. These are very intriguing questions that if we have the resources, we potentially could address.

We have not found any abnormalities for these mice other than the sleep duration so far (we have tested a few, but not extensive).

Since sleep regulation for sure will involve a complex molecular mechanism with many components, our approach is to use all the genes that we find as a starting points to keep expanding on the network. With each gene/protein, we are trying to keep ourselves unbiased and do whatever extensive molecular investigations are necessary to figure out how it causes the trait. Of course, we will take advantage of work done by others previously to help us expand the system. So far, the genes we find are different types, so it will not be a standard series of studies for all these genes.

Do the people who need less sleep take more naps?

[Jessiedee](#)

No. Not in the people who participate in our study.